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FARMERS' BULLETIN 374.

# Experiment Station Work, LIII.

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PREPARED IN THE OFFICE OF EXPERIMENT STATIONS.

A. C. TRUE, Director.

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# EXPERIMENT STATION WORK.

Edited by W. H. BEAL and the Staff of the Experiment Station Record.

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Experiment Station Work is a subseries of brief popular bulletins compiled from the published reports of the agricultural experiment stations and kindred institutions in this and other countries. The chief objects of these publications is to disseminate throughout the country information regarding experiments at the different experiment stations, and thus to acquaint farmers in a general way with the progress of agricultural investigation on its practical side. The results herein reported should for the most part be regarded as tentative and suggestive rather than conclusive. Further experiments may modify them, and experience alone can show how far they will be useful in actual practice. The work of the stations must not be depended upon to produce "rules for farming." How to apply the results of experiments to his own conditions will ever remain the problem of the individual farmer.—A. C. TRUE, Director, Office of Experiment Stations.

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# ILLUSTRATIONS.



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# EXPERIMENT STATION WORK.[a]

## INOCULATION AND LIME FOR ALFALFA.[b]

Quite generally more or less difficulty is encountered in obtaining a good stand of alfalfa when this crop is tried for the first time. It has been found that on many, if not most, soils this difficulty is largely due to the absence or ineffectiveness of the particular germs required for the crop on the one hand, and the lack of lime in the soil on the other, or to both factors acting together. It is generally recognized that, aside from such favorable soil conditions as proper drainage, adequate fertility, and good tilth, inoculation and lime are two principal factors in securing a successful stand of alfalfa, but data measuring their importance and effectiveness are not common. The New York Experiment Station at Geneva has recently published the results of work which serve as a measure of these two factors and which indicate to what extent their application may increase the chances of success. While this work refers to New York only, the results may be regarded as applicable to any locality in which similar conditions prevail.

Experiments of this nature were carried on for three years from 1905 to 1907, inclusive, but the more extensive part of the work was done during the latter year. In 1907 a series of cooperative experiments to study the influence of soil inoculation and lime was conducted under the direction of the station in different parts of the State. In thirty-two of the experiments one square acre divided into four equal plats was devoted to the test. The first plat received no treatment, the second was simply limed, the third was inoculated only, and the fourth received both inoculation and lime. This acre field was so located that the inoculation of the uninoculated plats could not take place through soil washing, and the uninoculated plats were sown and worked first to prevent inoculation by means of the implements. The station furnished the inoculating soil, which was sown broadcast at the rate of 200 to 300 pounds per acre, and also the lime, which was used at the rate of 1,500 pounds per acre.

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[a] A progress record of experimental inquiries, published without assumption of responsibility by the department for the correctness of the facts and conclusions reported by the stations.

[b] Compiled from New York State Sta. Bul. 313.

A study of the influence of the inoculating soil in the experiments for 1907 revealed that of 36 check plats 10 produced a successful yield of hay, while among an equal number of adjoining inoculated plats 18 gave successful yields. The influence of the inoculation was not limited to the fields which were changed from a failure to a success, but was noticeable on practically all fields except where the proper bacteria were already present in sufficient numbers. In a summary of the results for the three years it is shown that of 103 experimental fields only 25 yielded a successful crop of alfalfa without the use of inoculating soil, while of the adjoining plats to which inoculating soil had been applied 66 gave successful yields. The number of successful fields is here increased by 40 per cent as apparently due to the use of inoculating soil.

The results with reference to lime in 1907 showed that in 10 of 37 experiments profitable crops of hay were secured without its use, while of the adjoining plats treated with lime 18 produced profitable crops. Lime quite generally improved the yield. Taking the three seasons together, an improvement resulted in 54 of 64 fields under test. Only 11 of the unlimed plats gave profitable results, while 27 of the adjoining plats treated with lime produced successful crops. In these 64 tests the use of lime by itself increased the number of successful fields by 25 per cent, and all the fields giving good yields without lime were improved by its use. In no case did this moderate application of lime show any detrimental effects. While these results establish the principle that liming is generally profitable with alfalfa in New York, they do not solve the problem as to the most profitable quantity of lime to use; and as this varies for different fields, it must be worked out for each field by the farmer himself. Tests with litmus paper to determine whether or not a soil needs lime seemed to indicate that little information of value can be gained from this method.

Reliable data on the combined action of inoculation and lime were secured from 65 experiments. In this series only 12 of the untreated check plats produced a satisfactory crop of alfalfa, while of the adjoining plats, inoculated and limed, 50 were a success. The combined treatment had increased the chances of success from 18 per cent on the check plats to 77 per cent on the treated plats, or an increase of 59 per cent as apparently due to the treatment.

These experiments were generally conducted on land well drained, fairly fertile, and quite clean. The seed used was previously examined for dodder, trefoil, and other injurious weed seeds. It is concluded from the results that under these conditions the natural lack of inoculation and of lime is largely responsible for the difficulty experienced in obtaining a satisfactory stand of alfalfa in different

parts of the State. The lack of lime was very general, practically all fields responding to its application, but the lack of the proper bacteria was more often the controlling factor, since inoculation changed more than twice as many fields from failure to success as did the use of lime.

Attention is called to the fact that when land is already sufficiently provided with the required bacteria, inoculation is without any apparent effect upon the crop and that when sufficient inoculation is lacking the use of 150 to 300 pounds per acre of soil from an alfalfa field producing plants with nodules will supply the necessary bacteria. Inoculation and lime are effective only in so far as they are needed and are capable of doing little in producing a good stand and a profitable yield if other necessary conditions such as proper drainage, sufficient fertility, a clean soil, adequate tillage, and good seed are not provided.

Briefly summarizing the results it is found that without either lime or inoculation the chance of a successful crop is not more than 20 per cent, or one chance in five; with lime the chance of success is raised to 40 per cent, or two in five; with inoculation it is raised to about 60 per cent, or three chances out of five; while both lime and inoculation used together indicate a successful crop about four times out of every five trials.

## CITRUS CULTURE IN SOUTHERN TEXAS.[a]

With the recent active horticultural development in southern Texas there has arisen a demand for information relative to the adaptability and culture of the various citrus fruits in that region.

The culture of citrus fruits in the Gulf coast region generally has been rather fully discussed in a previous Farmers' Bulletin of this Department,[b] but in a recent bulletin of the Texas Agricultural Experiment Stations, S. A. Waschka gives an account of the experimental plantings of oranges, grape fruit, lemons, and kumquats at the Beeville Substation, together with information gained from plantings made elsewhere in the same region, which it is believed will be useful to the large number of people who have undertaken to grow citrus trees in southern Texas.

None of these plantings, however, are very old, and as Mr. Waschka says, "for the last five years, until the cold spell in January of this year (1909), the coast belt has not been visited by weather severe enough to test the endurance of the citrus trees." In January past the trees withstood a temperature which went as low as 20° to 24° over most of the citrus-fruit belt. This is considered an encouraging circumstance for the development of the industry.

[a] Compiled from Texas Sta. Bul. 118. [b] U. S. Dept. Agr., Farmers' Bul. 238.

### ORANGES.

In March, 1907, 30 varieties of 1-year-old orange trees were planted at the station. Of these the following varieties were bearing some fruit in 1908: Satsuma, Dugat, Washington Navel, Mandarin, Mediterranean Sweet, and Parson Brown. Other varieties are expected to bear during the present year. The experience of longer standing has been practically confined to two varieties of oranges, the Satsuma and the Dugat, garden plantings of which have been grown in southwest Texas for some considerable time with apparent success.

The Satsuma is the hardiest, and will resist more cold than any other orange. So far as our experience goes, the Dugat is the next hardiest. We have had more experience with these two than with any other variety. They are young and heavy bearers, and the fruit of both is excellent for market. The Dugat has produced 200 nice marketable oranges when the tree was 3 years old, and 250 when the tree was 4 years old. The Satsuma will do about the same thing if properly cared for.

### GRAPE FRUIT.

Grape fruit is not extensively planted in Texas, principally because it is not so well known as the orange. The following five varieties of grape fruit have been tried at the station thus far, all of which have proven to be heavy bearers the third year after planting: Triumph, Tresca, Duncan, Pernambuco, and Royal. The yields varied from 137 well-matured fruits on 4-year-old Triumphs to 648 well-matured fruits on 4-year-old Royal trees. Some of the individual fruits of the Tresca variety measured 5½ inches in diameter. In general the fruits averaged about 4½ inches in diameter.

### LEMONS.

The station tested only one variety of lemon, the Villa Franca. This proved to be a young, prolific bearer. The fruit "is excellent in size and quality, and will doubtless secure a permanent place in the markets. One-year-old trees planted in February, 1904, yielded as high as 164 lemons of excellent quality in 1908." It must be borne in mind, however, "that the lemon is not so hardy and resistant to cold as the orange and the pomelo."

### KUMQUATS.

Relative to kumquats, which are dwarf members of the citrus family and of value chiefly for ornament and as pickles, Mr. Waschka has the following to say:

We have grown two varieties of the kumquats, both of Chinese origin. The *Nagami*, oblong in shape, measuring about 1⅛ by 1¾ inches in diameter. The fruit of the *Marumi* variety is round, slightly flattened, and somewhat smaller than that of the

Nagami. The kumquat, when ripe, has a perfect orange color, rather acid, but very aromatic, and is an excellent relish. The Nagami bears fruit mostly in clusters, and when cut with leaves attached forms a very attractive table decoration. Both varieties make excellent preserves, and wherever known are in great demand. For market the fruit is usually packed in quart baskets and crated like strawberries or tomatoes. The trees are dwarfed, if, in fact, they may be considered trees, attaining a growth from 8 to 12 feet in height, and two-thirds this measurement across the head. They are very young and prolific bearers, setting a crop of fruit the first year after planting, comparing favorably in this respect with the Satsuma oranges, their hardiness being increased by using trifoliata stock to bud on. The low, dwarfish heads of the tree provide a great deal of protection to the trunk.

## CITRUS TRIFOLIATA AS STOCK.

On account of its hardiness, *Citrus trifoliata* is recommended as a stock to be used in southern Texas for all citrus trees, since, "to some extent, it seems to impart some of its hardiness to the scions worked upon it. The trees budded on this stock come into bearing at an earlier age, as a rule, and produce their fruit early in the season. * * * It has been claimed that the trifoliata stock dwarfs the tree, but this seems to be an error."

## SELECTION OF SOILS.

The following advice is given relative to the selection of soils for citrus culture:

It may be said that the citrus trees are apparently not very fastidious as to the type of soil best suited to them, and this is especially true if the right stock is chosen to work them on. Still, there are certain soils upon which we would not advise that they be grown. Sticky, heavy soils should be avoided for commercial groves. These soils are fertile enough, but they easily become dry and compact, unless under irrigation, and then they are more likely to become puddled or tamped and difficult to work. Soils that are not properly drained must, of course, be avoided; or soils that have hardpan are unsuitable, unless the hardpan is broken up so that the roots of the soil may easily penetrate it. Citrus trees are generally surface feeders, but still provision must be made for the roots to penetrate to such a depth as will firmly anchor the tree in the soil. The trees succeed best on well drained, loose soils, preferably, perhaps, on a sandy loam that gradually changes into a heavy loam, underlaid by pliable clay, 18 inches or more from the surface. Extremely open, porous soils are not desirable. A pure sandy loam, with a clay subsoil, is well suited, provided it is properly enriched by the application of fertilizers.

## PREPARATION AND CULTIVATION OF THE SOIL.

The land should be thoroughly prepared as for any other crop. It should be deeply plowed—if the rainfall is low—and pulverized by harrowing and smoothing. If sod land is to be used, it is best to break it about three times, say, 3 inches the first time, followed by disk harrow, and then followed by a lever or section harrow. The second plowing may be carried 5 or 6 inches deep, harrowed as in the first instance. In semiarid districts the third plowing should be as deep as practicable, say, 7 to 10 inches, and harrowed as before. It is preferable, of course, that the land be prepared as above before the trees are set out.

Mr. Waschka emphasizes the importance of thorough cultivation for the conservation of the soil moisture in dry climates or dry periods and the need of proper drainage in wet weather:

Proper cultivation at the proper time is often equal to irrigation; in fact, it is at times better, because if irrigation is not properly conducted it may work positive injury. Cultivation should be followed after each rain, or after each irrigation, if this be practiced. The ground should be properly worked with a harrow, or, if need be, with a cultivator, after every rain, in case the locality is one where the conservation of moisture is an important consideration. In fact, in such localities it is a good practice to keep the cultivator or harrow going during the dry season, say, to the middle of September, after which cultivation should cease, in order that tree growth may be checked and the wood hardened for the winter. Very deep plowing is not advisable after the tree begins to grow in the spring, but a plow may be used to advantage at some distance from the tree, and at some greater depth than the shallow cultivators give. The plow may be used even in December, but great care should be taken not to tear up the roots of the tree. Weeds of any kind should not be allowed to grow in the orchard at any time

## COVER CROPS.

The use of a leguminous cover crop is advised, "even though the land is rich in nitrogen, humus, and other plant food," for "such crops make the soil loose and mellow and prevent surface washing during rainy seasons, and at the same time regulate the moisture of the soil." The practice at the station has been to plant the cowpeas in rows about 3 feet apart and to cultivate them as long as the vines will permit. The vines are not allowed to run closer than 5 feet from the trees, so that the latter may be properly cultivated. "It is best to plant peas early in the spring, and, when the first pods are ripe, cut up the crop and soil with a disk harrow."

## FREEZES.

Although the winter climate in southern Texas is usually mild, the occurrence of severe freezes of short duration are by no means uncommon, and the trees should be given some sort of protection every year.

It is very essential to bank around the trees for winter, in order that a portion of the trunk may be preserved in case of a severe freeze. Should the trees get winter killed they should be cut back in the spring as far as they have been frozen, leaving the healthy wood to produce sprouts and make another tree, which they will do in two or three years. These mounds of earth should be removed as soon as all danger of a severe freeze is past—say, about the 1st of March. In the Gulf coast section of Texas, the trees may, as a rule, be left unprotected until about the 1st of December. Nothing but clean earth should be used in banking, and a considerable portion of the tops should be left exposed.

In a recent article dealing with the possibility of orange culture in South Texas, H. M. Stringfellow[a] called attention to the fact that

[a] Orange Trees for Texas. H. M. Stringfellow: Texas Farm and Ranch, 28 (1909), No. 2, pp. 10–12.

that section had been visited by killing freezes of short duration at irregular intervals several years apart. Among the methods suggested for the protection of tree tops, he advocated the trial of sheet asbestos as a wrapping for the trunk of the tree. A small mound of earth should be drawn up around the bottom of the wrapping, and a little cotton should be stuffed between the tree and the wrapping at the upper end in order to prevent the circulation of air beneath the wrapping.

In conclusion it may be said that the only drawback to commercial citrus culture in southern Texas which is worthy of serious consideration is that of the possibility of occasional spells of severe freezing weather. If, as has been the case in recent years, the interval between the periods of killing frosts is sufficiently long to permit of harvesting three or four crops of fruit, the industry might be placed on a paying basis in spite of the freezes, since citrus fruits in southern Texas come into bearing very early. Thus far, however, it appears that the Mandarin type of orange, which includes the Satsuma and Dugat, above mentioned, as well as several other varieties, is the only safe kind to plant in this section. Plantings of the ordinary sweet oranges, such as are grown in California and Florida, should be done merely in an experimental way. It might also be well to consider to what extent the market will call for oranges of the Mandarin type. It is quite possible that such varieties could soon be overplanted.

## PRUNING ROTUNDIFOLIA GRAPES.[a]

The scuppernong and other rotundifolia or muscadine grapes of the South are usually grown on arbors and allowed to ramble at will, since pruning is commonly considered detrimental to them. As a result, the vines become matted in the course of a few years and do not yield well except on the outer edges of the arbor. The vine-clad arbor is often valuable in providing a shady retreat about the home grounds and sometimes even for protecting stock from the sun. These grapes can be grown for market, however, to greater advantage and profit on wire trellises. Whether grown on arbor or trellis they will succeed better if rightly pruned. In a recent bulletin of the South Carolina Station, C. C. Newman says:

> To succeed in growing these grapes on an arbor or trellis we must prune freely every fall and never allow the vines to grow in masses. When the vines become too thick it is better to remove a few of the large canes rather than cut out a great many small ones. When the small canes are cut out it only relieves the trouble temporarily, as it induces them to branch freely and the vine becomes thicker than ever.

By conducting the sap through a rubber tube to a large glass jug Professor Newman compared the amount of sap lost through prun-

[a] Compiled from South Carolina Sta. Bul. 132.

ing vines at different periods. The following table shows the amount of sap collected from vines that were cut at different periods from October 20 to May 21:

*Sap lost from scuppernong vines pruned at different dates.*

| Date vines were cut. | Diameter of vine cut. | When bleeding began. | When bleeding ceased. | Amount of sap lost by each vine. |
|---|---|---|---|---|
| | *Inches.* | | | |
| October 20 | ½ | No bleeding... | No bleeding... | None. |
| Do | 1 | ....do..... | ....do..... | Do. |
| November 21 | ½ | ....do..... | ....do..... | Do. |
| Do | 1 | ....do..... | ....do..... | Do. |
| December 19 | ½ | Feb. 18..... | May 1..... | 2 ounces. |
| January 20 | ½ | ....do..... | May 15..... | 9 pounds 4 ounces. |
| February 21 | ½ | Feb. 21..... | May 18..... | 31 pounds 3 ounces. |
| March 20 | ½ | Mar. 20 ..... | ....do..... | 23 pounds 5 ounces. |
| Do | 1 | ....do..... | May 25..... | 33 pounds 6 ounces. |
| April 20 | ½ | ....do..... | May 10..... | 12 pounds 4 ounces. |
| May 21 | ½ | No bleeding... | No bleeding... | None. |

These results show that—

If the vines are pruned during the months of October and November there will be no injurious effects, but if they are cut later in the season, they will bleed badly and seriously injure if not destroy the vine.

If the pruning is delayed until after December, there will always be more or less injury to the vine caused by the loss of sap in the spring. After the vines have made a growth of from 5 to 6 inches in the spring, small vines may be cut without causing serious injury, but the large vines will bleed badly even at this season. Vines cut in late winter will not bleed until the weather begins to turn warm, but will then bleed freely. They will cease to bleed if the weather turns cool again, only to bleed more freely as the spring advances. A vine that has been pruned too late in the season will be so weakened by the loss of sap that it will be a week or ten days later in starting to grow than vines pruned in the early fall.

## NUTRITIVE VALUE OF NATIVE HAYS IN THE ARID REGIONS.[a]

Practical stockmen in the arid West declare that the native grasses and forage plants are the most nutritious in the world and point to the condition of their animals as offering abundant evidence of their assertions. It is a common practice among many ranchmen to flood their meadows during the irrigating season to such an extent that many of the true grasses are killed, so that the hay harvestings are often composed largely of rushes and sedges, which give a greater yield than hay made from grasses. In the past few years several experiment stations in that region have undertaken investigations to compare the nutritive value of the different grasses, sedges, rushes, and other native forage plants.

[a] Compiled from Colorado Sta. Buls. 93, 124; Nevada Sta. Buls. 62, 64; Wyoming Sta. Buls. 65, 68, 69, 78, 79.

The Nevada Station conducted experiments to determine the nutritive value of hay in different portions of the stalk and of the second-growth crop of native hay of the Truckee Meadows when fed to sheep.

These plants vary considerably in their feeding value. Owing to the unevenness of the land and the methods of irrigation in vogue, some parts of the fields receive a much larger amount of water than others. In the lowest places the water grasses, sedges, and rushes predominate, while in the higher parts the true grasses and clovers are more abundant. In consequence of this, a stack of native hay does not represent a uniform feeding value throughout. That portion of the stack composed largely of the native bluegrasses and clover is of a much better quality than that composed almost entirely of water grasses, sedges, and rushes. The rancher from whom we purchased the hay was anxious to find out the nutritive value of his hay and especially of the second-growth crop. This second crop is cut long before maturity and consists of the young, tender portions of the grasses, sedges, rushes, and clovers that have been produced after the removal of the first crop. It is strictly speaking the aftermath. The stockmen to whom he sold his hay in the fall and winter season for fattening sheep and cattle for market differed widely in their opinions as to the feeding value of this second crop. Some feeders regarded it highly, while others considered it worthless.

The botanical composition of the four samples was examined. The first sample, which consisted of second growth native hay, contained no plants which had reached maturity. The clover sample consisted largely of the introduced alsike clover and a native clover (*Trifolium spinulosum*). The bluegrass sample contained a great variety of grasses, but Buckley bluegrass (*Poa buckleyana*), alkali meadow grass (*Puccinellia airoides*), and spike rush grass (*Eleocharis arenicola*) predominated. The timothy sample consisted largely of timothy and tickle grass (*Hordeum jubatum*). About one-half of the wire-grass sample consisted of common wire grass (*Juncus balticus*) and brown-top sedge (*Carex athrostachya*).

Many native grasses, legumes, and forage plants are described in bulletins of the Nevada and Wyoming stations, and results of chemical analyses are given, which show them to be rich in nutritive constituents. The chemical composition alone, however, is not enough to determine the actual food value. It is the object of this article to summarize the work done at these experiment stations on the nutritive value of these native plants. At the Wyoming Station feeding experiments with sheep, begun in 1904 and continued up to the present time, show that the practical man is right in believing that these native grasses are fully as nutritious as the tame grasses of the East.

### WHEAT GRASSES.

In one experiment with wheat grasses 10 Shropshire and 10 Merino lambs were fed for sixteen weeks on alfalfa, corn, and turnips, and

made a gain of 31.2 pounds per head at a cost of 4.6 cents per pound. With another lot of lambs the alfalfa was replaced with an overripe and woody hay made from Western wheat grass (*Agropyron occidentale*). These lambs made an average gain of 20.7 pounds per head at a cost of 6.08 cents per pound. From later experiments with mixtures of wheat grasses it would appear that they are more nutritious than in the experiment previously quoted. "Practical experience has proven that the Western wheat grass is an excellent fodder, and results show that it is more nutritious pound for pound than timothy, which commands a higher price in western markets. There may be several reasons for favoring timothy, one of which is that it is very difficult to grow Western wheat grass free from foxtail, which depreciates the value of the crop, because of the injuries inflicted by foxtail upon animals feeding upon it. Then there is a prevalent idea that timothy is the only hay that should be used for horse feed." On the bottom lands along the water courses in Colorado there is a grass closely allied to the Western wheat grass and known locally as Colorado bluestem (*A. tenerum*). Samples of mixed hay containing a large proportion of this grass were obtained near Fort Collins and in the Box Elder Valley and were used for experiments at the Colorado Experiment Station. The Fort Collins sample was much more digestible, as is shown by the accompanying table.

### WIRE GRASSES.

Three sheep were used for digestion experiments with wire grasses, which were composed mostly of rushes and sedges. Out of 100 pounds of wire-grass hay about 50 pounds of the native hay was digested and assimilated. The digestibility of the protein was surprisingly low. Evidently the hay fed in this experiment was inferior to much of the hay used by stockmen.

In one feeding trial with small lots of lambs upon various grain rations and native hay [composed largely of wire grasses] the ration made up of native hay, oats, and oil meal proved to be the best of those tried, the lambs making a gain of 17.4 pounds per head in fourteen weeks, against 28.6 pounds made by the lot on alfalfa hay and corn. [Another experiment] with 40 lambs in each lot shows an average gain of 20.3 pounds in fourteen weeks by the lambs on native hay, oats, and oil meal, and 34.3 pounds by the lambs on alfalfa hay and corn.

The amount of feed required was 607 pounds of native hay, 460 pounds of oats, and 25 pounds of oil meal for 100 pounds of gain. In the previous experiment 574 pounds of hay, 591 pounds of oats, and 86 pounds of oil meal were required for 100 pounds gain.

The results of these two experiments indicate that the native hay, oats, and oil-meal ration will produce somewhat less than two-thirds the gain produced by alfalfa hay and corn in the same length of time, and also requires considerably more feed to produce 100 pounds gain.

## SWEET-CLOVER HAY.

In the South sweet clover is prized as an early pasture for sheep. Throughout the Eastern States it is regarded as a weed. In some sections of the West it is used as a pasture for pigs. At the Wyoming Station its digestibility as a sheep feed has been investigated.

At this altitude, under the peculiar conditions, it is believed by a few that there is a future for it since it grows well. It is an alkali-resisting plant, and although it is not palatable to stock in the green condition, yet after it is cured, especially where salt has been added, the stock relish it and thrive well upon it. It is very nutritious, readily digestible, and contains an exceedingly high percentage of crude protein. It is more nutritious when cut at the proper period than many of the other hays.

The sweet-clover hay used in this experiment was grown on the experiment-station farm near Laramie in 1905. It had been in stack for over a year before being used for this experiment. It was very rank at the time of cutting and the amount of stems, therefore, very large in proportion to the leaves. The stems had become rather hard and woody. Notwithstanding this, the hay proved to be a very narrow ration, since the nutritive ratio was only 1:3.2. The crude fiber did not run as high as would have been expected, being but 24.75 per cent.

A lot of 10 lambs that were fed on white sweet-clover hay, corn, and oil meal made an average gain of 30.7 pounds in fourteen weeks, while 10 lambs fed on alfalfa hay and corn made 34.4 pounds gain. "The former ate one-sixth more hay, somewhat more corn, and a small amount of oil meal. The larger consumption of sweet-clover hay was due to the fact that it was cut late and was very coarse and stemmy. The lambs liked it, however, and showed a steady appetite for it. There was not the slightest difficulty in getting them to eat it at the start."

## SALTBUSH.

The nutritive value of the saltbush (*Atriplex argentea*), used by the ranchmen, has been studied in sheep feeding experiments at the Colorado Experiment Station. "This saltbush is not to be mistaken for the Australian saltbush (*A. semibaccata*), which plant differs materially from *A. argentea*. The Australian saltbush has been recommended by the California Station as a forage plant in alkali soils." In tests made at the Wyoming Station this plant gave better results than the native silvery saltbush, but was not found to be a really good fodder. A chemical analysis indicates no reason except an abnormally high ash content why the native saltbush hay should not be at least a fairly good feed. The amount of ash, though large, is less than is found in the dried leaves of the sugar beet, which are fed, with excellent results, to both cattle and sheep. The results of the feeding experiment were, however, not favorable, as each of three sheep used in the experiments lost weight, one sheep losing one-half pound, one 2 pounds, and the third 6 pounds.

For convenience of comparison and reference, the results of digestion experiments with the various forage plants are collected in the following table:

*Digestible nutrients in 100 pounds of air-dried native hays.*

| Sample. | Protein. | Fat. | Nitrogen-free extract. | Fiber. | Nutritive ratio. |
|---|---|---|---|---|---|
| Western wheat grass (Wyoming): | *Pounds.* | *Pounds.* | *Pounds.* | *Pounds.* | *Pounds.* |
| 1904 | 3.81 | 1.09 | 33.32 | 20.69 | 1:14.86 |
| 1908 | 4.42 | 1.44 | 30.44 | 18.97 | 1:9.6 |
| 1908 | 4.15 | 1.42 | 31.48 | 20.29 | 1:13.2 |
| Wire grass (Wyoming): | | | | | |
| 1904 | 4.58 | 1.33 | 30.59 | 18.82 | 1:11.48 |
| 1906 | 2.25 | 1.07 | 28.85 | 18.68 | 1:20.9 |
| Sweet-clover hay (Wyoming) | 1.88 | .49 | 28.36 | 8.32 | 1:3.2 |
| Second growth native hay (Nevada) | 6.49 | 2.96 | 56.96 | ..... | 1:9.3 |
| Clover sample (Nevada) | 4.10 | 1.85 | 53.75 | ..... | 1:14.1 |
| Bluegrass sample (Nevada) | 3.43 | 2.36 | 53.02 | ..... | 1:17 |
| Timothy and tickle grass (Nevada) | 5.06 | 2.11 | 59.16 | ..... | 1:12.6 |
| Wire grass (Nevada) | 3.90 | 2.56 | 51.75 | ..... | 1:14.7 |
| Blue stem (Fort Collins sample) | 4.48 | .76 | 25.86 | 22.18 | 1:11.1 |
| Blue stem (Box Elder Valley sample) | 4.34 | .64 | 21.92 | 17.43 | 1:9.4 |
| Saltbush (Colorado) | 6.46 | .76 | 17.88 | 2.27 | 1:3.2 |

## BERMUDA GRASS.[a]

The success which has been attained at the Oklahoma Station with Bermuda grass as a pasture and hay plant has been briefly referred to in previous bulletins of this series.[b] From a recent bulletin of the Oklahoma Station on this subject, prepared by L. A. Moorhouse and others, the following summary is taken:

Bermuda grass is a native of tropical countries; however, it can be grown as far north in this State as the Kansas line. A few samples of Bermuda grass roots have been distributed in southern Kansas. Even if it is possible to start Bermuda by sowing seed, the crop should be propagated entirely by planting root cuttings.

Recent experiments appear to indicate that Hardy Bermuda grass, a type which has been developed by the experiment station, is a selection well adapted to Oklahoma conditions. Many farmers are planting this grass not only for the purpose of preventing soil erosion on roadsides and on very rolling fields, but they are also securing sods in order to provide the live stock of the farm with suitable pasture throughout the hot summer months.

Unless the soil is well prepared, the grower can not expect to secure a complete stand if unfavorable weather conditions prevail. During the month of May the rainfall is usually abundant, hence this is the best time of the year to plant Bermuda roots. A suitable temperature is an essential feature in starting this crop.

After the soil has been placed in good tilth, the roots or sods may be dropped in rows which are 30 to 36 inches apart; 18 inches is a suitable distance for spacing the pieces in the row. Grass which has been down several years may be improved by cultivation and manuring.

Reviewing the experiences of a large number of growers we find that this grass is regarded with favor in many widely separated districts. A few observations with white clover which was sown on a Bermuda-grass lawn have given us some reason to

[a] Compiled from Oklahoma Sta. Bul. 85.

[b] U. S. Dept. Agr., Farmers' Buls. 281, p. 10; 320, p. 12.

believe that these two plants can be used as a pasture mixture with profit. Some feeding tests have been made with Bermuda hay; it compares very favorably with such standard types as timothy or Kentucky blue grass.

Since this grass reproduces by underground root stems as well as by seed, some have thought that eradication would be impossible; however, by adopting the proper plan, this grass may be destroyed and other crops can be grown upon the same area. In planting roots the grower should confine this grass largely to areas which are to be used for permanent pasture.

As regards eradication, it is stated that while "Bermuda grass should be planted only on those areas which are to be used for permanent pastures, there may be cases where it is expedient to plow up the grass after it has become firmly established. In such cases quite thorough treatment must be given. The soil should be turned to a depth of 3 or 4 inches during the latter part of November or early in December. The turf may remain exposed to the frosts of winter and thorough surface cultivation can be given in the spring of the year. A crop which will produce a dense covering or shade should be selected and planted. Cowpeas or sorghum answer well for this purpose. Bermuda grass does not thrive in the shade; thus the winter exposure and the check which is placed upon it during the summer months will assist in destroying the major portion of the crop."

A circular of the Bureau of Plant Industry of this Department [a] makes the following suggestion regarding the eradication of Bermuda grass:

The very qualities which render Bermuda so valuable as a pasture grass serve to make it an aggressive and pestiferous weed. On account of its tendency to spread and insinuate itself into the land where it is not wanted and to persist in fields which are to be used for other purposes, it has in many cases not been utilized to the extent that its good qualities would indicate. However, it can be eradicated from a field with comparative ease by proper cultivation. Since it will not thrive in the shade, it is only necessary to smother it out by some quick-growing crop. The method recommended by southern agriculturists and which may be modified to suit conditions is to plow the land after the last crop of hay is cut, if the field is a meadow, or about this season if it is a pasture. Sow the field to oats, wheat, or to some thick-growing crop. When this crop is harvested, plow the land immediately and plant to cowpeas. It is probably best to plant these in drills and cultivate them until the vines meet, after which they will shade the ground and prevent the growth of Bermuda. Usually this treatment is sufficient to destroy the Bermuda completely, but if not, the process can be repeated.

## SHORT VERSUS LONG FEEDING OF BEEF CATTLE.[b]

Since the prices for feed stuffs have been so high there has been a tendency in the Central West when purchasing feeders to buy mature

[a] U. S. Dept. Agr., Div. Agrostology Circ. 31.

[b] Compiled from Indiana Sta. Bul. 130; Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 34 (1908); Canada Expt. Farm Rpts. 1906.

cattle and thus shorten the feeding period. This method of feeding has given rise to the term "short-fed cattle." At the Indiana Station experiments have been in progress the past two years to ascertain the comparative profits secured from feeding cattle by the two methods. In the two series of experiments reported two lots of 10 steers each were fed shelled corn, cotton-seed meal, clover hay, and corn silage.

Two lots of cattle were started on feed at the same time each year. The "long-fed" steers used averaged at the beginning of the first test 1,010 pounds, and would have graded as good, fleshy feeders; the "short-fed" steers averaged 1,175 pounds and were carrying too much flesh to be classified as feeders, but would have been sold as killers if placed on the market at the time they went into the experiment. * * * The first test began November 21, 1906, and closed for the "short-fed" lot February 19, 1907; for the "long-fed" lot, May 20, 1907. The second test started November 17, 1907, and closed for the "short-fed" cattle March 15, 1908, and for the "long-fed" cattle May 15, 1908. * * * The variation in the price of corn during the two winters when the work was conducted, together with the fluctuation in the price of fat cattle, makes it necessary to use different prices in computing profit or loss from feeding. In the financial statements corn is valued at the prevailing market prices at the time of feeding; cotton-seed meal at $28 per ton, clover hay at $10 per ton, and corn silage at $2.50 per ton.

In the experiments of 1906–7 the average daily gain per head for the long-feeding period was 2.57 pounds, at a cost of 7.59 cents per pound, and for the short period 3.16 pounds, at a cost of 6.98 cents per pound, estimating corn to be worth 40 cents per bushel. In 1907–8 the corresponding average daily gain of the long-fed steers was 2.66 pounds per head, at a cost of 7.91 cents per pound, and of the short-fed steers 2.85 pounds, at a cost of 7.83 cents per pound.

In the first test the total amount of corn necessary to finish each steer was 34 bushels in the "short-fed" lot and 54.6 bushels in the "long-fed" lot; in the second test, 42.5 bushels in the "short-fed" lot and 61.1 bushels in the "long-fed" lot.

In the first test it was necessary to put on 285 pounds per head in the "short-fed" lot and 464 pounds in the "long-fed" lot to attain the same marketable finish; in the second test 318 pounds in the "short-fed" lot and 479 pounds in the "long-fed" lot.

During the period when both lots of cattle were in the feed lot there was a greater profit per head from feeding the heavier, fleshier steers.

In the first test the margin necessary to prevent loss on the "short-fed" cattle at the time of marketing was 48 cents per hundred; on the "long-fed" cattle at the same time 50 cents, and on the "long-fed" cattle at the time of marketing $1.04 per hundred.

In the second test the margin necessary to prevent loss on the "short-fed" cattle at the time of marketing was 92 cents per hundred; on the "long-fed" cattle at the same time $1.01 per hundred, and at the time of marketing $1.54 per hundred.

The cost of gains was cheaper on the thinner cattle during the first three months of the test, but when fed to the same marketable finish the cost of gains was practically the same.

In short feeding cattle for late summer and fall markets it is necessary to start with very fleshy feeders of excellent beef type in order that they will not sell in competition with western grass-fat cattle.

During the winter of 1907–8 there was a marked improvement in cattle values between the time of marketing the "short-fed" and "long-fed" cattle, which makes

a showing in favor of the long period very much better than it would be if prices had remained stationary.

* * * The data presented * * * clearly show that lighter and thinner cattle make cheaper gains than heavy, fleshy feeders if fed the same length of time, but where fed to the same marketable finish the cost of gains will be practically the same; that heavy, fleshy feeders, suitable to be finished in 90 to 110 days, will cost practically 50 cents more per hundred than cattle similar in every respect except that they do not carry so much flesh; that the difference in cost of the fleshy feeders and light thin feeders both during the fall of 1906 and 1907 was not great enough to offset the difference in the cost of making gains in the feed lot. This shows that it is generally cheaper to buy flesh on the feeders than to put it on in the feed lot. It was necessary to put on 464 pounds during the first test and 479 pounds during the second test on the "long-fed" cattle, and 285 pounds in the first test and 318 pounds in the second test on the "short-fed" cattle, while in the feed lot, to make them equally fat. It was necessary for the "short-fed" cattle to increase in value 16.6 cents per month for a three months period, while it was necessary for the "long-fed" cattle to increase 17.5 cents per month for a six months period, with corn at 40 cents per bushel, in order to break even on feeding cattle without counting the value of either hogs or manure.

Experiments in feeding short versus long periods have been conducted at the Ontario Experiment Station for several years. In one of the later experiments 8 steers fed for 77 days made an average daily gain of 2.25 pounds. The same number of steers fed for 160 days on the same ration made an average daily gain of 2 pounds. During the 3 years these experiments have been in progress the short-fed steers as a rule have returned higher prices per steer than the long-fed steers. At the Canada experimental farms the best results have sometimes been obtained with the long-fed steers. In one case 7 steers fed for 180 days gained 2.36 pounds per day, at a cost of 4.26 cents per pound, while a similar lot of 8 animals fed for 130 days gained at the rate of 2.08 pounds per head per day, at a cost of 4.85 cents per pound.

On the whole, these results at the different experiment stations are to the advantage of the short-fed steer, but a change in market conditions might easily reverse the situation. For some time there has been a good demand for the short-fed steer, and feeders have been inclined to let them go in an unfinished condition. These conditions may not hold for any length of time, for if too many join the ranks of short feeders the price of short-fed cattle may not be commensurate with the long-fed, as there are some consumers who demand prime beef from the finished steer. The success of the feeder will depend on his skill in buying, feeding, and in forecasting market conditions.

## CONTAGIOUS ABORTION OF CATTLE.[a]

This is a disease with which every cattle raiser and dairyman should be acquainted, as it is liable to be introduced into his herd, and a

[a] Compiled from Arizona Sta. Bul. 51; Connecticut Storrs Sta. Rpt. 1907, p. 139; Kansas Sta. Bul. 136; U. S. Dept. Agr., Bur. Anim. Indus. Circ. 67; Jour. Compar. Path and Ther., 19 (1906), No. 3, p. 191. See also U. S. Dept. Agr., Farmers' Bul. 237, p. 32.

failure to recognize and deal with it intelligently may result in considerable loss. Such loss occurs not only through the death of the offspring but through a diminished milk production.

Abortion, sometimes known as "slinking," "casting," or "losing" the calf, is the term given to the expulsion of the fetus at any time before the completion of the full term of normal pregnancy. While it may be produced in many ways, as by an injury, improper food or treatment, etc., by far the greater number of cases is due to one of several germs and are known as contagious abortions. Nocard in France and Bang in Denmark have found bacteria, and the Scottish commission found as many as five separate kinds which produce the disease. In this country V. A. Moore, of the New York Cornell Station, and F. D. Chester, formerly of the Delaware Station, have found organisms differing somewhat in the two States, but evidently of the same group with the colon bacillus. Dr. James Law concludes that any micro-organism which can live in or on the lining of the membrane of the womb, producing a catarrhal inflammation, and which can be transferred from animal to animal without losing its vitality or potency, is of necessity a cause of contagious abortion. The disease is transmitted from one animal to another by contact, by means of the discharge from the cow that has aborted, the afterbirth, dead calf, and from bulls that have served cows affected with the disease. It appears to be more or less prevalent throughout the country. Dr. Leonard Pearson, state veterinarian of Pennsylvania, in his report for 1906 states that abortion was never so prevalent as it is to-day. Doctor Barnes, of the Kansas Station, reported the disease to be quite common in Kansas in 1906, and Professor Wilson, of the Arizona Station, reports it to be present in a number of herds in that State.

The disease occurs more frequently in dairy herds than in any others, although beef cattle, sheep, horses, and goats may become infected. The prevalence of this disease in dairy herds is probably due to the weakened condition of dairy cows caused by the continuous drain of giving milk. Recent reports from the Storrs and New Mexico stations discuss its occurrence and eradication from the station herds.

At the Storrs Station the disease was introduced into the herd through the purchase of six pure-bred pregnant animals, two of which aborted shortly afterward. During the next three years 24 of the 79 calvings were premature births. This indicates that the contagion was not extremely virulent or that the treatment delayed to some extent the progress of the disease.

The premature births occurred at from 145 days to 262 days from time of conception, and the average of the 24 cases was 211 days. The bull was not the sole means of

spreading the disease in this instance. The 24 conceptions that terminated in premature births were the result of the matings of 15 different sires, eight of which were owned by parties remote from the affected herd.

At the Arizona Station the disease appears to have been originally communicated by the herd bull. Five cows aborted in the farm herd, of which four were sold for beef and one retained for experimental purposes. Under strict sanitary conditions this cow was served by the herd bull and in due time dropped a living calf. A number of cows have since been served by this bull without signs of abortion.

At the Storrs Station in order to determine the value of aborting cows as milk producers the milk and fat yields of ten cows following a normal calving are compared with the milk and fat yields during the period of abortion.

These cows, following a normal calving, averaged 5,892 pounds of milk and 282.8 pounds of fat in one year. During the next 2.1 years, or from one normal calving to the next normal calving, which included the aborting period, these cows averaged 5,196 pounds of milk and 268.4 pounds of fat per year. The milk was 696 pounds, or 12 per cent less per year during the aborting period. These ten cows aborted seven months (averaged 211 days) after conception. The satisfactory yields are attributed in part to the complete removal of the afterbirth and the thorough disinfection of the animals after abortion.

In regard to the potency of animals which have aborted, Professor Beach reports as follows:

Only one of the twenty-four animals that experienced a premature birth failed to breed after aborting. This animal was killed and the post-mortem examination showed the presence of an ovarian tumor which may or may not have been caused by the treatment administered to induce conception. Twenty-three of these cows produced a normal calf 461 days subsequent to abortion. * * * Experience indicates that it is useless to attempt to breed a cow for four or five months subsequent to aborting. Time must be given to recuperate. The success in getting these cows in calf after the premature delivery is attributed in part to the use of the yeast treatment. A yeast cake dissolved for twenty-four hours in a pint of warm water was injected into the vagina several days in succession previous to the time of mating.

The following advice as to preventive treatment and remedial measures is given by Professor Wilson:

It is well to call some competent veterinarian, in a case of contagious abortion, so that the farmer may learn the need of careful work in cleaning all infected places, and, also, the technique regarding the use of the syringe. After a few trials this manipulation becomes easy and he will soon learn to employ the necessary care in keeping this disease in check. * * * All cows that have aborted or that are suspected should be isolated from healthy animals. Just as soon as a cow aborts the offspring and afterbirth should be destroyed by burning and the immediate surroundings treated with lime after the trash has been removed and burned; all woodwork should be thoroughly disinfected by the use of corrosive sublimate. This can be obtained, with directions for use, at any drug store. A second disinfection with corrosive sublimate should take place ten days later. * * * Cows that have aborted should be washed out daily with a 1 per cent solution of creolin or lysol until

all discharge is stopped. It is somowhat risky to use this treatment with pregnant cows, but in this caso a tablespeonful of sodium hyposulphito, once in twenty-four hours, should bo given as a drench. All of these, with directions for using, may be obtained at nearly any drug storo.

During the past few years Prof. Bernard Bang, of Denmark, has carried on experiments in attempting to immunize cows, sheep, and goats against the disease. He has observed that aborting cows acquire a certain degree of immunity. His treatment produced abscesses and other symptoms of reaction, but considerable immunity resulted, and he hopes that this method of vaccination will ultimately give a means of controlling the disease.

## PREVENTING LOSSES AT LAMBING TIME.[a]

During the lambing season of 1908 there was such a heavy loss of lambs in Virginia that W. J. Quick and A. P. Spencer, of the Virginia Experiment Station, made an investigation into the causes of this exceptional loss, with a view to suggesting means of reducing such losses. The facts recorded and the conclusions drawn from the investigation have a wide practical application.

It was found that "in 73 flocks visited 961 lambs were lost out of 5,252 dropped, or 19 per cent. In 65 flocks reported by letter, 1,478 lambs were lost out of 8,068 dropped, or 18 per cent. Figuring on this basis for the State as a whole, 70,147 lambs, valued at $350,375, were lost in Virginia during the lambing season of 1908.

"The estimated loss from natural and unpreventable causes was 14,029 lambs, valued at $70,145. The estimated loss from preventable causes was 56,118 lambs, valued at $280,590." The loss due to (1) cold and exposure was 40 per cent; (2) lack of milk, 31 per cent; (3) weakness, 9 per cent; (4) disease and accident, 3 per cent; (5) worrying by dogs, 1 per cent; (6) natural causes, 16 per cent.

Deaths from natural causes are classed as those for which no specific reason could be given. "In large flocks, even with the best of care, a small percentage of lambs will be lost. This is particularly true where the number and the conditions are such that individual ewes can not be separated immediately before lambing. It was apparent that some losses reported as natural were due to inattention."

While the conditions observed in this investigation were undoubtedly exceptional and the percentage of preventable loss given is probably unusually large, it is safe to say that as a rule the danger of loss at lambing time is sufficiently great to make it wise for sheep raisers generally to give more attention to protective measures. To this end Professors Quick and Spencer suggest that more attention should be given to the selection of vigorous breeding stock and to

[a] Compiled from Virginia Sta. Bul. 178.

providing suitable protection against the weather. Expensive sheds are not considered necessary, but ewes and young lambs should have some protection from the north, east, and west winds. Sufficient shelter room should be provided to accommodate the entire flock without crowding. About 12 square feet of floor space should be allowed per sheep.

Thero should be a warmer arrangement for ewes when they drop in bad weather and each ewe should be separated from the flock when she lambs. Tho location should bo high and dry. The building should be liberally supplied with bedding to prevent dampness and insure cleanliness. A yard should bo attached having a dog-proof fence.

In this the sheep should be confined every night as soon as the weather becomes unfavorable.

The most favorable time for lambs to drop, if intended for the June market, is apparently between February 15 to March 1.

Lambs dropped before this date suffer tho hardships of the winter, and unless the ewes are very liberally fed do not get sufficient milk to make them grew rapidly. These lambs become more or less stunted and have not a plump and attractivo appearanco when marketed. There is also a greater possibility for loss with theso lambs, and a much longer season for heavy feeding with tho ewes, making an additional expense without a corresponding increase in weight, while lambs dropped after February 15 are less liable to loss from the most severe winter weather.

The great loss due to lack of milk can be largely prevented if the ewes for a month previous to lambing receive palatable foods rich in protein. A mixed grain ration of oats, corn, and bran is considered preferable to any of these grains fed alone, "but in case it is desired to feed any one alone, oats are most suitable. Corn alone is not very satisfactory, as it has a tendency to produce weakened lambs and a small milk flow." Clover, cowpea, or soy-bean hay, corn silage, turnips, sugar beets, and well-cured corn fodder may constitute the greater portion of the bulky ration. "It is very important to have sufficient feeding room, as the danger from crowding and pushing when ewes are heavy in lamb is very great and likely to cause some cases of abortion."

The flock should be closely watched at lambing time, for frequently a lamb can be saved if an attendant is present at the proper time.

The young ewes especially often require assistance in lambing. If a ewe does not drop her lamb within a reasonable length of time after labor pains are noticeable, there is a cause for the delay. Frequently a lamb is coming with its head bent back over its shoulder, or perhaps twins are coming together, or some other unnatural position. A little manipulation of the fetus will frequently straighten out the difficulty, thereby saving tho life of tho lamb, and not infrequently that of tho ewe.

Some ewes refuse to own their lambs, and other ewes refuse to let the lambs nurse. Some ewes will accept strange lambs. When a ewe loses her lamb it is advisable to keep up her milk flow by milking, as she will frequently accept a strange lamb if it is given to her soon after lambing. Frequently a set of triplets or twins are dropped by a owe and sho has not sufficient milk to proporly nourish all. If tho owe

that has lost her own lamb is placed in a close pen and away from other sheep she will readily adopt one of the twins or triplets, thereby raising a good lamb instead of running idle and becoming too fat for breeding the following season. An orphan lamb may often be given a ewe that has just lost a lamb if the dead lamb is rubbed over the strange lamb while wet, or the skin of the dead lamb tied on the orphan, since the ewe's affections are directed by the odor of her lamb. * * *

While the loss from dogs is reported as comparatively small, the dog nuisance is nevertheless a great detriment to the sheep industry of Virginia. The direct loss from severe chasing and worrying is often not so great as the loss that follows. Breeding ewes that have been badly worried and frightened rarely, if ever, entirely recover. The result is usually weak and inferior lambs at the next lambing season, with some abortions and many abnormal presentations of the fetus. In fact, many breeders of registered sheep consider their breeding flock almost ruined after having been severely chased by dogs. Frequently a large number of ewes will not breed for some time after being chased and badly frightened.

The remedy for this nuisance is of course an efficient dog law rigidly enforced. In the absence of this legal protection resort may be had to dog-proof fences and like means of protection. At best, however, such fences are expensive. A dog-proof fence constructed at the experiment station at a cost of 65 cents per rod is described as follows (fig. 1):

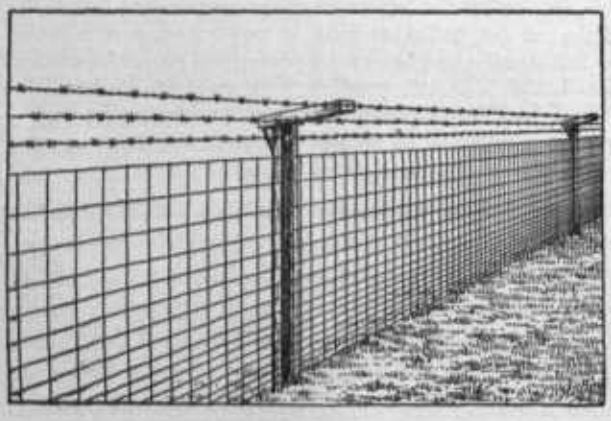

FIG. 1.—Dog-proof fence.

The woven-wire fence consists of 17 horizontal wires, the three lower wires 1½ inches apart, the width between wires gradually increasing to 5 inches at top. The vertical stays are 6 inches apart. The wire is fastened to posts set 25 feet apart, the bottom wire being 3 inches from the ground. One barbed wire is set midway between the bottom horizontal wire and the ground. One barbed wire is fastened to the posts 3 inches higher than the top wire. Two barbed wires are attached 8 inches apart to pieces of 2 by 6 scantling nailed to the posts above the wire with 20-penny nails. These pieces are set outward and upward with the posts.

*Cost of materials.*

| | | Cents. |
|---|---|---|
| Red cedar posts | each.. | 12½ |
| Woven-wire fence | per rod.. | 37½ |
| Four barbed wires | do.... | 15 |
| Total | do.... | 65 |

The 2 by 4 scantling costs about $18 per thousand and adds about 1 cent per rod to cost of the fence.

Any other closely constructed fence would answer the same purpose.

## WINTER LAMBS FOR THE PACIFIC COAST MARKET.[a]

Believing that there was a ready market for winter lambs in San Francisco at Easter time, as well as in the Eastern States, Professor True, of the Nevada Experiment Station, raised some crossbred Dorset-Merinos for this purpose.

In the spring of 1905 thirty half-blood Dorset ewes were ready for the experiment. They were turned in with the ram the middle of July, with the result that lambs were born from December 10 to February 21. Ten ewes lambed in December, thirteen in January, and seven in February.

It will be remembered that the month of December and a part of January were characterized by unusually stormy, wet weather. Half of the lambs came during this time of snow and mud, and the only shelter they had was that furnished by a shed boarded up for not more than 3 feet above the ground. In spite of these adverse conditions, the lambs made a very satisfactory gain of over four pounds a week. The ewes were fed alfalfa hay, chopped roots, and grain consisting of a mixture of barley and bran. The lambs were also fed grain separately.

The attempt to find a market for the lambs when grown resulted very satisfactorily. To begin with, Reno and Goldfield butchers and the Palace Hotel of San Francisco offered 20 cents a pound, dressed weight, for the lambs. After receiving the first shipment of lambs, however, the Palace Hotel wired an order for more at 35 cents a pound on board the cars at Reno, and took all that we could supply at that price.

From this experience it is apparent that at least there is a limited market in San Francisco for first-class lambs throughout the winter season.

## FEEDING WORK HORSES.[b]

The subject of an efficient and economical feed for work horses is one that is of interest not only to all farmers but to a large number of people who live in towns and cities. The grocer and butcher as well as the liveryman and the head of an express or transfer company are vitally interested in knowing what ration will give the greatest efficiency at the least cost.

There is a widespread belief among horse owners that no grain is equal to oats as an efficient feed for horses and that no matter how high the price of oats, no other grain can be used as a substitute for them.

In order to test the accuracy of this belief, B. E. Carmichael, of the Ohio Station, began in the spring of 1907 an extensive series of experiments to test the relative value and efficiency of oats and corn as a grain ration for work horses.

With this in view, three teams of grade Percheron geldings were taken; these horses were used for general farm and team work on the station farm. The horses in each team were about the same age; one was fed on oats and the other on corn. The plan was to feed as

[a] Compiled from Nevada Sta. Bul. 63. [b] Compiled from Ohio Sta. Bul. 195.

much ear corn by weight as oats. All the horses received as much mixed clover and timothy hay as they would eat. The experiment reported was continued forty-eight weeks. The variations in weight of the corn-fed horses were practically the same as those of the horses receiving oats; nor was it noticed that there was any difference in spirit or endurance between the mates of each team.

In regard to the comparative cost of the feeds it is stated that—

> Under the market conditions that prevailed during the experiment the saving from the use of corn was very marked—approximately 10 cents per day for each horse for the entire forty-eight weeks. Market conditions should always be borne in mind, as there may be times during which oats would be cheaper than corn, and they should, of course, be used whenever cheaper.

Some preliminary conclusions drawn from the first year's experiment are as follows:

> While the work reported in this bulletin has not been conducted for a sufficient length of time nor with enough animals to justify any very comprehensive statements, yet it seems that some facts have been pretty well established. The work is being continued, and it is hoped that the cumulative effects, if any result, of the long-continued use of grain rations made up exclusively of corn and of oats may be determined. The following statements, based upon the work done thus far, seem to be warranted by the data presented heretofore. It must be understood that the horses were mature geldings and that mixed clover and timothy hay was fed.
>
> The corn-fed horses endured hard work during hot weather as well as did the oats-fed horses.
>
> The use of corn to the exclusion of other grain for a period of forty-eight weeks was not detrimental to the health of work horses.
>
> The use of corn for work horses did not induce laziness and lack of endurance. Neither did the use of oats induce increased spirit and endurance.
>
> When mixed (clover and timothy) hay was fed to mature geldings at general farm work, ear corn was practically as efficient, pound for pound, as oats.
>
> On the basis of the results of this experiment and statistical records of farm values of grains, corn has, since 1866, been cheaper than oats as a grain feed for work horses.

It is planned to continue this work for a number of years and thus eliminate any variations that may be due to individual horses.

During the second year the horses received reversed rations, that is, the corn-fed horses received oats and vice versa. It should also be noted that the variation in weight during twelve weeks, when the corn-fed horses received shelled corn instead of ear corn, seems to indicate that the shelled corn was not so thoroughly masticated and therefore less efficient.

Station work with various rations for horses has been reported in a previous bulletin of this series.[a]

## COLONY HOUSES FOR POULTRY.[b]

The main requirements of a good poultry house are good ventilation and protection from storms and cold winds. Hens will not lay when

[a] U. S. Dept. Agr., Farmers' Bul. 316, p. 22.

[b] Compiled from Arkansas Sta. Bul. 99; Oregon Sta. Circ. 4; Utah Sta. Bul. 102.

weather conditions prevent them from scratching and exercising. Many poultry houses have failed because the variations in night and day temperatures were too great. At many of the experiment stations it has been found that open-front houses are more successful than houses with glass windows.

J. Dryden and A. G. Lunn, in a circular of the Oregon Station, state that—

Ventilation can best be furnished by leaving one end of the house open or covered with burlap or canvas, using no glass windows unless necessary for light. The idea of building a warm house should be abandoned. It is shelter that is needed. The house should be built in such a way that the fowls will not roost near the open front where they would be exposed to winds; nor should it face the prevailing winds. A long house is more expensive to build, for a given capacity, than one more nearly square. A long, narrow house is also a cold house, having more exposed surface for a given capacity than a square house.

The size of house necessary for a certain flock will vary in different sections. Where there is little or no snow and where the fowls can be outdoors every day in the year, two square feet of floor space per fowl will be ample. Where the climate is such that the fowls will seek shelter part of the year, rather than go outdoors on the range, considerably more space should be provided, say four to five square feet per fowl. The idea should be not to crowd them so much that their activity will be interfered with. Whether the shelter is provided by enlarging the house or providing cheap scratching sheds is immaterial. Two square feet per fowl, or even less, is ample for roosting quarters.

W. S. Jacobs, of the Arkansas Station, states that—

Roosts should be made low or near the ground—not higher than 2 feet. There are several reasons for this. Fowls of the heavier breed can not fly high, and those of the lighter breeds frequently injure the soles of their feet in jumping from high perches. Roosts should be made all the same heights; for if they are made some higher than others the birds will all flock to the highest ones and crowd, which is undesirable.

When dropping boards are used they should be low down, to permit of easy cleaning. They should be made of matched lumber and be 20 inches wide for one perch and 3 feet wide for two perches, the first perch placed at least 10 inches from the wall. A good roost may be made from material 2 by 2 inches, then slightly rounded on the edges.

According to Dryden and Lunn—

Poultry keeping is most successful where the colony system prevails. The colony system means the housing of fowls in small houses, preferably portable, where the fowls have free range. The chief advantage is that the fowls are more active or busier than when confined in yards; second, there is less danger from outbreaks of disease, as it is possible to keep the houses on clean ground by moving them occasionally; and third, the fowls require less feeding and care, as they pick up considerable food on the range. Another advantage of this system is that the fowls will rid the farm of many injurious insects, such as grasshoppers. Then, the colony system will fit in with crop rotations and for part of the year the fowls will live on the stubble fields.

Figure 2 represents a successful colony house with a cloth front, which was used at the Utah Experiment Station. The trap nests in the rear of the building can be opened from the outside (fig. 3). Fig.

4 is an illustration of a Rhode Island closed-front house. A good size to build a colony house is 7 by 12, which is large enough to accommodate 30 to 40 fowls, yet is not too heavy to be drawn by a pair of horses when it is desired to move it to a new location. Below are

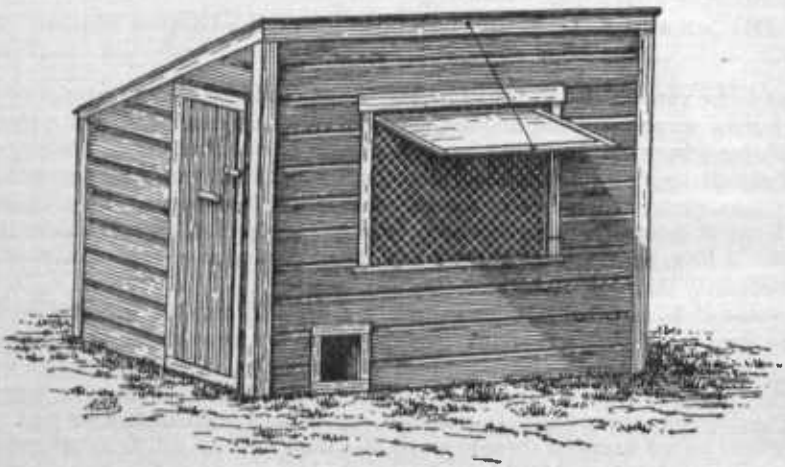

FIG. 2.—Utah Station colony house with cloth window.

given the details for constructing a colony house (fig. 5) of this size, as recommended by the Oregon Experiment Station.

**Construction of the colony house.**—The runners are made of 3-inch by 6-inch by 14-foot rough material and act as side sills for the house. They should be beveled

FIG. 3.—Utah Station colony house showing trap nests opening at the rear.

at ends, in order to slide easily. The cross sills are 3 inches by 4 inches by 7 feet. They are set 2 inches into the runners and 12 inches from the ends, and fastened with ½-inch bolts. When the siding is put on vertically there is no studding used. The plates are 2 inches by 3 inches by 12 feet, halved at each end. To the plates are nailed the 1-inch by 12-inch by 5-foot side boards, and these are battened with 1-inch by

3-inch. The siding is nailed flush with the top of plate and laps 3 inches on runners. The roof is one-third pitch, or 2 feet 4 inches at peak from top line of plates. There are five pairs of rafters, cut with a 1-inch plumb cut at plate. The roof boards are 1-inch

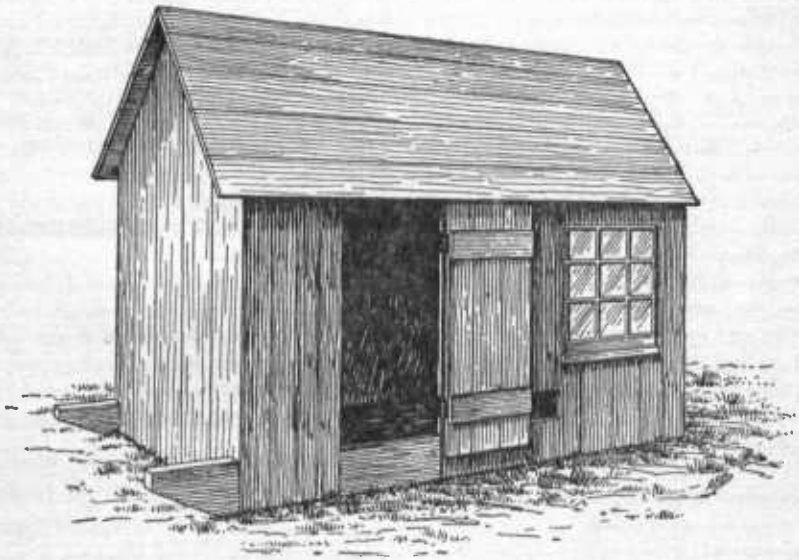

FIG. 4.—A Rhode Island closed-front colony house.

by 3-inch material, set 3 inches apart. The roof is shingled and laid 5 inches to the weather. The front is covered with 1-inch mesh wire. The cornice is made of 1-inch by 8-inch boards and projects 5 inches outside of walls. The frieze board, 1 inch by

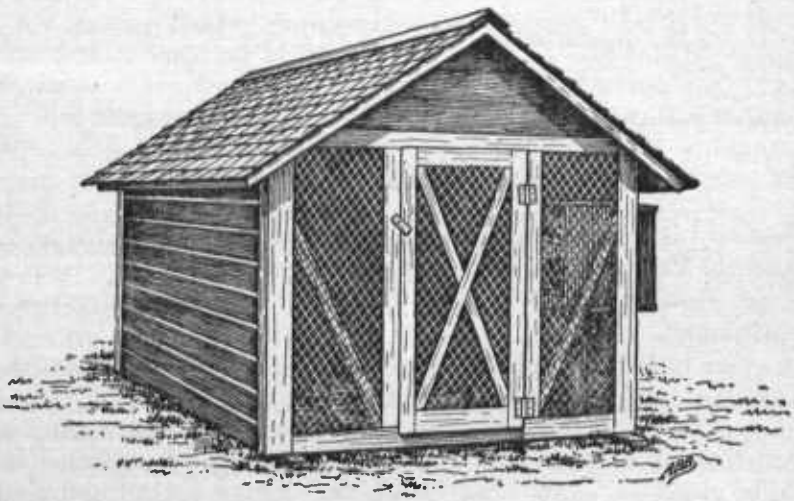

FIG. 5.—Oregon Station colony house.

4 inches, is nailed up tight against the cornice. The door is 2 feet by 6 feet and made from 1-inch by 3-inch material. The nest platform is 2 feet from the ground. It is nailed to a cleat on the side of the house and braced from top of runner. The platform is 22 inches by 5 feet. The nests are made of 5-gallon oil cans, the top and part of front

being cut out; 2 inches is left of front to hold in nest material, and a small strip at top which acts as a brace. Over the nests is fitted a sloping top, which keeps the chickens from standing on nests, and helps to darken the nests. The dropping platform is made of 1-inch by 8-inch ship-lap, is 2 feet 6 inches from floor in front and 2 feet 9 inches in rear. The slope permits the board to be cleaned more readily. For the same reason the boards should be put on from front to rear. The perches are made of 2-inch by 3-inch material, set flat. They should also be level and about 12 inches from dropping board in front. The roosts are set 18 inches apart.

**Lumber bill.**—Sills (runners), 2 pieces 3 inches by 6 inches by 14 feet, rough.
Cross pieces, 1 piece 3 inches by 4 inches by 14 feet, rough.
Plates, rafters, roosts, 134 lineal feet, 2 inches by 3 inches, sized.
Siding, 13 pieces 1 inch by 12 inches by 10 feet; 4 pieces 1 inch by 12 inches by 14 feet, finish No. 2.
Cornice, 54 lineal feet 1 inch by 8 inches, finish No. 2.
Base, 52 lineal feet 1 inch by 6 inches, finish No. 2.
Ridge and nest platform, 20 lineal feet, 1 inch by 5 inches, finish No. 2.
Frieze and corner boards, 80 lineal feet, 1 inch by 4 inches, finish No. 2.
Battens and trimmings, 330 lineal feet 1 inch by 3 inches, finish No. 2.
Dropping board, nest cover, 80 lineal feet 1 inch by 8 inches, ship-lap No. 2.
Shingles, 1,000.
Cost of lumber, $14.51.
**Hardware.**—5 pounds 8d. cut nails.
1 pound 8d. wire finish.
2 pounds 6d. wire finish.
3 pounds 2d. shingle nails.
1 pound 1½-inch brads.
18 feet poultry netting, 1-inch mesh 2 feet wide.
1 pair 4-inch T hinges.
1 lock.
Cost of hardware, $1.60.
**Paint.**—1 gallon creosote, shingle stain.
1 gallon paint.
Cost of paint, $2.
Cost of all material at Corvallis, $18.11.

## FOOD OF THE CROW BLACKBIRD.[a]

This bird is very common throughout the Eastern States and the Mississippi Valley, and its characteristics and habits have been very fully described in a bulletin of the Bureau of Biological Survey of this Department.[b]

In order to find out whether the bird as it occurs in Kentucky is to be regarded as a pest or not, H. Garman, of the Kentucky Station, examined the stomach contents of specimens secured during each month from April to November, inclusive, except June, when none could be obtained, as the birds during that month scatter and become very shy.

[a] Compiled from Kentucky Sta. Bul. 130.
[b] U. S. Dept. Agr., Bur. Biol. Survey Bul. 13.

In all, 67 birds were examined and the average percentage of vegetable food was 63.08 and of insect food 36.92. Professor Garman concludes from the results of his examinations that—

> The blackbird eats a larger proportion of vegetable than of insect food, taking the season as a whole; that the per cent of insect food rises highest from May to July and then falls suddenly in August, while vegetable food is eaten in greater quantity from this latter month until the end of the season; that the proportion of insect food increases and the vegetable food declines whenever insects become common and easy to secure in the situations most frequented by the birds. This willingness to eat insects when they can be secured is shown by the large numbers of June bugs eaten in July, and again by the rise in the per cent of insect food during a period of clear weather in October. We may fairly assume from these facts that the blackbird relishes its insect diet, and would, in case of the insects it eats most becoming exceptionally common and destructive, increase the per cent of its insect food correspondingly and thus serve as a check upon the insects. Considered in connection with the fact that much of the grain eaten is certainly gleaned and of no value, the insect food in the stomachs seems to show that the bird is a useful one. Further study may lead to some modification of this view, but at the present time it is my opinion that the shooting of the crow blackbird should not be permitted, except, as in the case of other small birds, when it is found actually engaged in destroying crops.

These conclusions are in general accord with those previously reached by F. E. L. Beal, as stated in the bulletin of the Biological Survey referred to above.

## FLOUR FOR MAKING BAKING POWDER BISCUITS.[a]

Under the direction of Miss Mary U. Watson, who is in charge of the Home Economics Department of the Ontario Agricultural College, studies were made of the relative value of different types of flour for making baking powder biscuits. Strong high-grade patent flours made wholly of Manitoba wheats, and soft nearly straight grade flours made from Ontario wheats, a blend of 20 per cent B. strong and 80 per cent C. soft wheat, an 85 per cent soft flour and a 35 per cent soft flour, both made wholly from Ontario wheat, were selected. The bakings were made under uniform conditions with weighed quantities of flour, fat, baking powder, and milk. "In every baking each ingredient was carefully weighed, the biscuits compared with others, and results recorded to guide the procedure of the next experiment. When rolling out the dough before cutting the biscuits, flat sticks of equal thickness were laid on either side for the rolling-pin to travel upon, so that the biscuits of all bakings were as nearly alike in thickness before baking as was possible with dough of such slackness. Only the biscuits cut from the first rolling were baked, so that no biscuits were made from dough that had been worked over."

[a] Compiled from Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 34 (1908), pp. 242–247.

With the strong flours the proportion 150 grams flour, 12 grams butter, and 8 grams baking powder gave the best results. As regards oven temperature, 450° F. proved most satisfactory. The loss in weight in baking the biscuits ranged from 14 to 22 per cent of the initial weight. With the soft flours and the blend much the same range of loss in weight in baking was noted.

As regards the relative value of the different sorts of flour for the purpose studied, the author concludes that "other things being equal, soft wheat flours make tenderer milk biscuits than strong wheat flour."

Given a strong wheat flour dough and a soft wheat flour dough of equal slackness and suitable for milk biscuits, the soft wheat flour dough is the easier to handle.

At the present prices of the different flours the strong wheat flour biscuits cost more than soft wheat flour biscuits.

It is possible that a larger proportion of fat used with the strong wheat flour would yield biscuits of tenderness equal to those of soft wheat flour, but the cost of fat makes that method of improvement a disadvantage.

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